

## Claims

- 1 1. A quantum information processing platform comprising,  
2 a plurality of quantum information processing elements each having,  
3 a cage defining a cavity formed from a plurality of self-assembling protein molecules,  
4 and one or more cargo elements located within the cavity, wherein  
5 at least one of the cargo elements comprises a qubit programmable into a plurality of  
6 logical states.
- 1 2. A quantum information processing platform according to claim 1, wherein the quantum  
2 information processing elements comprise,  
3 receptors for capturing and positioning the one or more cargo elements within the cavity.
- 1 3. A quantum information processing platform according to claim 2, wherein the quantum  
2 information processing elements comprise,  
3 a vesicle located within the cage and enclosing the one or more cargo elements, wherein  
4 the receptors extend through the vesicle to capture and position the cargo element within the  
5 vesicle.
- 1 4. A quantum information processing platform according to claim 3, wherein the quantum  
2 information processing elements comprise,  
3 adaptors disposed between the receptors and the cage and binding to the receptors.
- 1 5. A quantum information processing platform according to claim 1, wherein the quantum  
2 information processing elements comprise,  
3 a vesicle located within the cage and enclosing one or more cargo elements.
- 1 6. A quantum information processing platform according to claim 1, wherein the quantum  
2 information processing elements comprise,  
3 molecular tethers for capturing and positioning one or more cargo elements within the  
4 cavity
- 1 7. A quantum information processing platform according to claim 1, wherein the quantum  
2 information processing elements comprise,  
3 direct cage bonding for capturing and positioning one or more cargo elements within the  
4 cavity.

- 1 8. A quantum information processing platform according to claim 1, wherein the quantum  
2 information processing element comprise,  
3 receptors, molecular tethers and direct cage bonding for capturing and positioning one or  
4 more cargo elements within the cavity.
- 1 9. A quantum information processing platform according to claim 1, wherein the one or  
2 more cargo elements of a subset of the quantum information processing elements further  
3 comprises a non-permeable cavity.
- 1 10. A quantum information processing platform according to claim 3, wherein the one or  
2 more vesicles of a subset of the quantum information processing elements further comprises a  
3 non-permeable cavity.
- 1 11. A quantum information processing platform according to claim 1, wherein  
2 the cage is electrically neutral and inhibits charge transfer between the cage and its cargo  
3 elements.
- 1 12. A quantum information processing platform according to claim 1, wherein the cage  
2 reduces the tendency of a plurality of logical states in a coherent state to collapse into a  
3 decoherent state.
- 1 13. A quantum information processing platform according to claim 1, wherein the cage  
2 inhibits non-quantum information processing cargo elements from interfering with qubit cargo  
3 element operation in other cages.
- 1 14. A quantum information processing platform according to claim 3, wherein the vesicle is  
2 electrically neutral and inhibits charge transfer between the vesicle and its enclosed cargo  
3 elements.
- 1 15. A quantum information processing platform according to claim 3, wherein the vesicle is  
2 insulative and reduces the tendency of a plurality of logical states in a coherent state to collapse  
3 into a decoherent state.
- 1 16. A quantum information processing platform according to claim 4, wherein the receptors  
2 and adaptors are electrically neutral and inhibit charge transfer between the vesicle and cage and  
3 their cargo elements.
- 1 17. A quantum information processing platform according to claim 1, wherein the cage  
2 reduces contaminant background radiation to cargo carried within the cage.

- 1 18. A quantum information processing platform according to claim 3, wherein the vesicle  
2 reduces contaminant background radiation to cargo carried within the vesicle.
- 1 19. A quantum information processing platform according to claim 1, comprising  
2 a self-assembling framework of cages to structurally support one or more of the self-assembling  
3 quantum information processing elements.
- 1 20. A quantum information processing platform according to claim 1, comprising  
2 a self-assembling electrically neutral substrate of cages to structurally support one or more of the  
3 self-assembling quantum information processing elements.
- 1 21. A quantum information processing platform according to claim 1, comprising a self-  
2 assembling framework of cages to structurally order one or more self-aligning ones of the  
3 quantum information processing elements.
- 1 22. A quantum information processing platform according to claim 1, wherein the one or  
2 more cargo elements of a subset of the quantum information processing elements is a single  
3 cargo element comprising a qubit programmable into a plurality of logical states.
- 1 23. A quantum information processing platform according to claim 1, wherein the one or  
2 more cargo elements of a subset of the quantum information processing elements are a plurality  
3 of cargo elements.
- 1 24. A quantum information processing platform according to claim 23, wherein the plurality  
2 of cargo elements are qubits programmable into a plurality of logical states.
- 1 25. A quantum information processing platform according to claim 23, wherein at least some  
2 of the plurality of cargo elements are non-quantum information processing cargo elements.
- 1 26. A quantum information processing platform according to claim 1, wherein the one or  
2 more cargo elements of a subset of the quantum information processing elements respond to  
3 stimuli internal and external to the cage.
- 1 27. A quantum information processing platform according to claim 3, wherein the one or  
2 more vesicles of a subset of the quantum information processing elements respond to stimuli  
3 internal and external to the vesicle.
- 1 28. A quantum information processing platform according to claim 1, wherein the one or  
2 more quantum information processing elements and their qubit and non-QIP cargo are used in  
3 vitro.

- 1 29. A quantum information processing platform according to claim 23, wherein a subset of  
2 the non-quantum information processing cargo elements include one or more therapeutic agents.
- 1 30. A quantum information processing platform according to claim 23, wherein a subset of  
2 the non-quantum information processing cargo elements include one or more diagnostic agents.
- 1 31. A quantum information processing platform according to claim 23, wherein a subset of  
2 the non-quantum information processing cargo elements include one or more sensor agents.
- 1 32. A quantum information processing platform according to claim 23, wherein a subset of  
2 the non-quantum information processing cargo elements include one or more prosthetic agents.
- 1 33. A quantum information processing platform according to claim 23, wherein a subset of  
2 the qubit and non-quantum information processing cargo elements include one or more quantum  
3 dots.
- 1 34. A quantum information processing platform according to claim 23, wherein a subset of  
2 the qubit and non-quantum information processing cargo elements include one or more photonic  
3 dots.
- 1 35. A quantum information processing platform according to claim 23, wherein a subset of  
2 the cargo elements include one or more liquids without dopants or with one or more dopants of  
3 any type.
- 1 36. A quantum information processing platform according to claim 23, wherein a subset of  
2 the qubit and non-quantum information processing cargo elements include a gas or vapor without  
3 dopants or with one or more dopants of any type.
- 1 37. A quantum information processing platform according to claim 1, wherein the at least  
2 one qubit of a subset of the plurality of quantum information processing elements are  
3 programmed by one or more pulses of electromagnetic radiation.
- 1 38. A quantum information processing platform according to claim 37, wherein the  
2 electromagnetic radiation has a frequency in the UHF region.
- 1 39. A quantum information processing platform according to claim 37, wherein the  
2 electromagnetic radiation has a frequency in the microwave region.
- 1 40. A quantum information processing platform according to claim 37, wherein the  
2 electromagnetic radiation has a frequency in the radio region.

- 1 41. A quantum information processing platform according to claim 1, wherein the at least  
2 one qubit of a subset of the quantum information processing elements includes an unpaired  
3 electron and the plurality of logical states of the qubit are defined by electron spin polarization.
- 1 42. A quantum information processing platform according to claim 1, wherein the at least  
2 one qubit of a subset of the quantum information processing elements includes a nucleus and the  
3 plurality of logical states of the qubit are defined by nuclear spin polarization.
- 1 43. A quantum information processing platform according to claim 1, wherein the at least  
2 one qubit of a subset of the quantum information processing elements includes an unpaired  
3 electron, and the plurality of logical states of the qubit are defined relative to an energy  
4 difference.
- 1 44. A quantum information processing platform according to claim 1, wherein the at least  
2 one qubit of a subset of the quantum information processing elements includes a nitroxide  
3 molecule.
- 1 45. A quantum information processing platform according to claim 1, wherein the at least  
2 one qubit of a subset of the quantum information processing elements includes a free radical  
3 molecule.
- 1 46. A quantum information processing platform according to claim 1, wherein the at least  
2 one qubit of a subset of the quantum information processing elements includes a qubit that is  
3 photon-based and the plurality of logical states of the photon-based qubit includes a coherent  
4 logical state.
- 1 47. A quantum information processing platform according to claim 1, wherein the plurality  
2 of logical states includes a coherent state.
- 1 48. A quantum information processing platform according to claim 1, wherein the plurality  
2 of logical states includes a coherent state at room temperature.
- 1 49. A quantum information processing platform according to claim 1, wherein the cage  
2 bioengineered in whole or in part.
- 1 50. A quantum information processing platform according to claim 1, wherein the self-  
2 assembling protein molecule is a clathrin molecule
- 1 51. A quantum information processing platform according to claim 1, wherein the cage  
2 comprises self-assembling synthetic protein molecules.

- 1 52. A quantum information processing platform according to claim 4, wherein receptors,  
2 adaptors, and vesicle comprise natural or synthetic protein molecules.
- 1 53. A quantum information processing platform according to claim 4, wherein the receptors,  
2 adaptors, and vesicle are bioengineered in whole or in part.
- 1 54. A quantum information processing platform according to claim 1, wherein at least a  
2 portion of the cage is metal coated.
- 1 55. A quantum information processing platform according to claim 4, wherein at least a  
2 portion of the receptors, adaptors, and vesicle is metal coated.
- 1 56. A quantum information processing platform according to claim 1, wherein the cage is  
2 substantially greater than one nanometer in diameter.
- 1 57. A quantum information processing platform according to claim 1, wherein the cage is at  
2 least about 50 nanometers in diameter.
- 1 58. A quantum information processing platform according to claim 1, wherein the cage is at  
2 least about 100 nanometers in diameter.
- 1 59. A quantum information processing platform according to claim 1, wherein the cage is  
2 symmetric with respect to a plane.
- 1 60. A quantum information processing platform element according to claim 1, wherein the cage  
2 has icosahedral geometry.
- 1 61. A quantum information processing platform according to claim 1, wherein at least one of  
2 the plurality of cages includes a plurality of qubits and a subset of the plurality of qubits are  
3 linearly positioned at vertices along a single plane using circulant ordering.
- 1 62. A quantum information processing platform according to claim 1, wherein a subset of the  
2 quantum information processing elements are physically linked together.
- 1 63. A quantum information processing platform according to claim 1, wherein a subset of the  
2 quantum information processing elements are functionally linked together, either locally or at a  
3 distance.
- 1 64. A quantum information processing element according to claim 1, comprising  
2 an encoder for programming the at least one qubit of a subset of the quantum processing  
3 elements.
- 1 65. A quantum information processing element according to claim 1 comprising,

2 a decoder for reading information out of the at least on qubit of a subset of the quantum  
3 processing elements.

1 66. A quantum information processing platform according to claim 1, wherein a subset of the  
2 quantum information processing elements form a hybrid system upon their physical or functional  
3 integration with non-invention elements in vitro and in vivo.

1 67. A method for a quantum information processing platform comprising,  
2 providing one or more quantum information processing elements, each quantum  
3 information processing element comprising  
4 a cage defining a cavity formed from a plurality of self-assembling protein molecules,  
5 and

6 one or more cargo elements located within the cavity, wherein,  
7 at least one of the cargo elements comprises a qubit programmable into a plurality of  
8 logical states;

9 programming the one or more quantum information processing elements using an  
10 encoder; and

11 reading information from the one or more quantum information processing elements  
12 using a decoder.